What is the relationship between the environment, body weight, and fruit/vegetable intake?

Conclusion

An emerging body of evidence has documented the impact of the food environment and select behaviors on body weight in both children and adults.

Moderately strong evidence now indicates that the food environment is associated with dietary intake, especially less consumption of vegetables and fruits and higher body weight. The presence of supermarkets in local neighborhoods and other sources of vegetables and fruits are associated with lower body mass index (BMI), especially for low-income Americans, while lack of supermarkets and long distances to supermarkets are associated with higher BMI. Finally, limited but consistent evidence suggests that increased geographic density of fast food restaurants and convenience stores is also related to increased BMI.

Grade: Moderate

Overall strength of the available supporting evidence: Strong; Moderate; Limited; Expert Opinion Only; Grade not assignable For additional information regarding how to interpret grades,click here.

Evidence Summary Overview

This conclusion is based on the review of 10 systematic reviews that investigated the relationship between the environment and body weight, energy intake and vegetable and fruit intake (Black, 2008; Casagrande, 2009; Dunton, 2009; Ford, 2008; Giskes, 2007; Holsten, 2009; Jago, 2007; Kamphuis, 2006; Papas, 2007; van der Horst, 2007). All 10 studies suggested associations between the environment and body weight and dietary intake, but indicated that more research is still needed to better understand these linkages. Three studies found that neighborhood-level measures of economic disadvantage (unemployment, income, education) are associated withobesity and poor dietary intake (Black, 2008; Ford, 2008; Kamphuis, 2006). Eight studies found that the availability of healthy food, or lack thereof, through supermarkets and distance to a supermarket is associated with weight status and dietary intake (vegetable and fruit intake) (Casagrande, 2009; Ford, 2008; Giskes, 2007; Holsten, 2009; Jago, 2007; Kamphuis, 2006; Papas, 2007; van der Horst K, 2007). One study found that lack of access to outdoor space for physical activity, hazards (trash and noise), and number of locked school yards were positively associated with childhood obesity and access to recreational facilities and bicycling and walking trails were negatively associated with childhood obesity (Dunton, 2009). Two studies found that higher density of fast food restaurants and convenience stores is associated with higher rates of obesity (Holsten, 2009, Papas, 2007).

Evidence summary paragraphs:

Black JL and Macinko J, 2008 (positive quality) conducted a systematic review to investigate neighborhood determinants of obesity. A literature search was conducted from August 2005 through March 2007 by systemically searching the PubMed and PsychInfo databases, with a focus body weight, dietary intake and physical activity as outcomes. The following neighborhood

characteristics were reviewed: Macro-level social, historical, and economic factors that shape overall neighborhood context; neighborhood or meso-level living conditions, such as infrastructure and services; local availability and quality of food; neighborhood characteristics that promote or inhibit physical activity. The final sample included 37 studies that included an outcome variable of body weight or diet. Decreased neighborhood-level measures of economic and social resources (unemployment, income, education, poverty level, community disadvantage and material deprivation) were consistently associated with higher obesity rates in 15 studies. However, associations between neighborhood income inequality and racial composition with obesity were mixed. Although there is growing evidence that the availability of healthy food in a neighborhood is associated with food choices (especially fruit and vegetable consumption among low-income households), the net impact on obesity is unclear.

Casagrande SS et al, 2009 (positive quality) conducted a systematic review to examine the relationships between the built environment, diet and obesity among African Americans. A PubMed search was conducted to find articles that evaluated the objective or perceived physical built environment, included dietary behaviors and obesity or body mass index (BMI) as outcomes, had subject populations that were 90% or more African Americans and 18 or more years of age, and were published through July 2007. The final sample included 10 articles. Results showed that the presence of supermarkets and specialty stores was consistently positively associated with meeting fruit and vegetable guidelines. The authors note that because of the relatively few studies that have been published on this topic focusing on African Americans, few conclusions can be drawn regarding features of the built environment that influence dietary intake or weight.

Dunton GF et al, 2009 (positive quality) conducted a systematic review to investigate the influence of the built and biophysical environmental on overweight and obesity in children and adolescents. Included studies were found using PubMed, PsychInfo and Geobase searches for studies that measured one or more features of the built or biophysical environment; measured BMI, overweight or obesity; reported results on youth aged zero to 18 years; and were published before May 2008. The final sample included 15 studies (nine with more than 1,000 subjects; seven on children aged three to 12, seven on adolescents aged 13 to 18 and one on children and adolescents aged three to 18). 86% of the studies were cross-sectional only, one included cross-sectional and longitudinal samples and one was quasi-experimental. Vegetation density, presence of hazards (e.g., litter, trash, noise), and number of locked schoolyards were positively correlated with obesity in children. Intersection density, road safety and the number of and access to recreational facilities and bicycle and walking trails were negatively correlated with BMI. The number of and distance to schools, private recreational facilities, parks and gyms were not correlated with BMI. Adolescents living in rural, exurban and mixed urban were more likely to be overweight than individuals living in newer suburban, older suburban and inner city areas. The author concluded that overall, few consistent findings emerged, as associations between physical environmental variables and obesity differed by gender, age, socioeconomic status, population density and whether reports were made by the parent of child.

Ford PB and Dzewaltowski DA 2008 (neutral quality) conducted a systematic review to examine whether disparities in the US retail food environment are associated with obesity. A PubMed search was conducted looking for studies on the "food environment," "nutrition environment," "food access," "food availability" and "obesity" that were published between 1992 and 2007. The final sample included 13 studies (three ecological, four cross-sectional and three that were multi-level designs). There is relatively consistent evidence that socioeconomically disadvantaged neighborhoods with high proportions of racial and ethnic minorities have poorer quality retail food environments, as measured by access to and availability of healthy foods, compared to more affluent areas with comparatively small populations of ethnic and racial minorities. The authors hypothesize

that while the quality of the food environment affects food choice and eating behaviors among both high and low socioeconomic status (SES) groups, the economic resources available to those with higher SES have a protective effect on eating patterns. Therefore, the authors conclude that poor-quality retail food environments in disadvantaged areas, in conjunction with limited individual economic resources, contribute to increased risk of obesity within racial and ethnic minorities and socioeconomically disadvantaged populations.

Giskes K et al, 2007 (positive quality) conducted a systematic review to examine associations between environmental factors, energy and fat intakes among adults. PubMed, Human Nutrition, Web of Science, PsychInfo and Sociofile were searched to identify studies published from 1980 to 2004 that included energy intake, total and saturated fat intakes or fruit and vegetable intakes as outcomes, and included access and availability to healthy foods, social conditions related to inter-personal relationships, cultural conditions and material, housing, and neighborhood conditions as independent variables. The final sample included 21 studies. Fourteen of 22 studies found significant relationships between environmental factors and energy intake. Sixteen of 39 studies found significant relationships between environmental factors and total fat intake. Nine of 20 studies showed significant relationships between environmental factors and saturated fat intake. However, the authors note that potentially relevant environmental factors from social-ecological models for health behaviors were relatively understudied in relation to specific dietary outcomes. Therefore, it is too premature to conclude that the environment does or does not play an important role in unhealthy dietary behavior among the adult population.

Holsten JE, 2009 (positive quality) conducted a systematic review to examine the relationship between obesity and the community and consumer food environment. MEDLINE, CINAHL, PubMed, Cochrane Central Register of Controlled Trials and CRISP were searched in order to find studies that included BMI as a continuous or categorical variable and that had a physical measurement of environmental variables related to food outlets. The final sample included seven studies. Five studies found significant associations between obesity rates and community food environment variables, while two studies did not. Significant findings were related to presence of different types of food stores, fruit and vegetable prices, disadvantage of the food store neighborhood, distance travelled to the food store, and distribution of fast food restaurants on a state-wide basis. However, the authors noted that many of the studies were subject to limitations that may have mitigated the validity of the results, and study design varied widely. Therefore, the authors did not draw any overall conclusions.

Jago R et al, 2007 (neutral quality) conducted a systematic review to examine the relationships between food availability and consumption of fruits and vegetables, and to highlight how increasing availability has been used to increase consumption of fruits and vegetables. A search of PubMed and PsycINFO was conducted using the following keywords: Availability, accessibility, fruit and vegetables and studies published between 1993 and 2006 were included. The final sample included 31 studies. Availability of fruits and vegetables was related to consumption and the degree of availability differed by socioeconomic status but not ethnicity. Home availability of fruits and vegetables is both directly and indirectly associated with children's consumption. Preferences are a consistent indicator of consumption and the association between intake and availability is moderated by preferences. Interventions to increase consumption have been successful with continued intake over time with continued availability. Based on these findings, the authors concluded that availability of fruits and vegetables is associated with intake, and changes in availability are likely to mediate changes in consumption.

Kamphuis CB et al, 2006 (positive quality) conducted a systematic review to summarize the existing empirical evidence pertaining to environmental influences on fruit and vegetable

consumption. A search was conducted to identify observational studies published between January 1, 1980 and December 31, 2004 that included adults aged 18 to 60 years old. The independent variables of interest were accessibility and availability of fruits and vegetables, social conditions, cultural conditions and socioeconomic conditions, and the dependent variables were fruit and vegetable intake. The final sample included 24 studies. Residing in an economically advantaged area, good local availability of fruits and vegetables, having a vegetable garden and the presence of a supermarket in the census tract were all environmental factors positively associated with fruit and vegetable intake. Living in an economically disadvantaged neighborhood and having a low household income were negatively associated with fruit and vegetable intake. The authors concluded that consumption of fruits and vegetables is likely to be higher among people with higher incomes, those living in an advantaged neighborhood and those who have a good local availability and accessibility of fruits and vegetables. However, they note that there is not enough evidence available to justify large-scale interventions targeting those environmental determinants.

Papas MA et al, 2007 (positive quality) conducted a systematic review to examine the published empirical evidence on the influence of the built environment on the risk of obesity. A MEDLINE search was conducted to identify studies published between 1966 and 2007 that included a direct measurement of body weight and at least one objective measure of the built environment. The final sample included 20 studies. Obesity was found to be positively associated with fast food restaurant density, increased presence of convenience stores and greater distance to a supermarket, and negatively associated with lower food prices for fruits and vegetables. The authors concluded that while obesity was found to be associated with environmental factors related to healthy food access, more research on the impact of the built environment on obesity is needed.

van der Horst K et al, 2007 (positive quality) conducted a systematic review to examine the relationship between environmental factors and obesity-related dietary behaviors in children and adolescents. Studies included in the review were identified through a computerized database search, were published between January 1980 and December 2004, had subjects aged three to 18 years, measured obesity-related dietary behaviors (energy or fat intake, intake of fruit and vegetables, snack food, fast food and soft drinks), and assessed some aspect of the environment. The final sample included 58 studies. Environmental determinants of fruit and vegetable intake were examined in 34 studies, determinants of fat intake in 23 studies, determinants of fast food and snack intake in 21 studies, determinants of energy intake in 17 studies and determinants of soft drink intake in 10 studies. Environmental factors are predominantly studied at the household level and focus on sociocultural and economic aspects. A positive association was found for availability and accessibility on children's fruit and vegetable intake, though this relationship was inconsistent. The authors conclude that more studies examining environmental factors using longitudinal study designs and validated measures are needed for solid evidence to inform interventions.

View table in new window

Author, Year, Study Design, Class, Rating	Participants	Methods	Outcomes

Black and Macinko 2008 Study Design: Systemic Review Class: M Rating:	N=37 studies.	A PubMed and PsychInfo search was done from August 2005 through March 2007. Inclusion criteria were: Outcomes of weight, physical activity or diet; assessment of neighborhood level indicators; conducted in humans.	Decreased neighborhood-level economic and social resources were associated with ↑ obesity rates in 15 studies. Associations between neighborhood income inequality and racial composition with obesity were mixed. Healthy food availability is associated with food choices (especially fruit and vegetable consumption), but the impact on obesity is unclear.
Casagrande et al 2009 Study Design: Systemic Review Class: M Rating:	N=10 studies.	A Pubmed search was done through July 2007. Inclusion criteria were: Evaluated the objective or perceived physical built environment, included dietary behaviors and obesity or BMI as outcomes and had subject populations that were 90% or more African American and 18 years of age or older.	The presence of supermarkets and specialty stores was consistently positively associated with meeting fruit and vegetable guidelines. The lack of studies on this topic made it difficult to draw conclusions on features of the built environment that influence dietary intake or weight.
Dunton et al 2009 Study Design: Systematic review Class: M Rating:	N=15 studies.	Searches of PubMed, PsychInfo, and Goebase were done through May 2008. Inclusion criteria were: Measured one or more features of the built or biophysical environment; measured BMI, overweight or obesity; and reported results on youth aged zero to 18 years.	Findings varied by age, gender, SES, population density, and whether reports were made by the parent of child. Vegetation density, presence of hazards and number of locked schoolyards were positively correlated with BMI.

			Intersection density, road safety and access to recreational facilities and trails were negatively correlated with BMI. Those living in rural, exurban, and mixed urban areas were more likely to be overweight than those living in suburban and inner city areas.
Ford and Dzewaltowski 2008 Study Design: Narrative review Class: M Rating: 	N=13 studies.	A PubMed search was conducted looking for studies on the "food environment," "nutrition environment," "food access," "food availability" and "obesity" that were published between 1992 and 2007.	Poor-quality retail food environments in disadvantaged areas, in conjunction with limited economic resources, contribute to ↑ risk of obesity within racial and ethnic minorities and disadvantaged populations.
Giskes et al 2007 Study Design: Systematic Review Class: M Rating: 	N=21 studies.	PubMed, Human Nutrition, Web of Science, PsychInfo and Sociofile were searched to identify studies published from 1980 to 2004 that measured energy intake, total and saturated fat intakes or fruit and vegetable intakes as outcomes, and environmental factors.	14 studies found relationships between environment and energy intake. 16 studies found relationships between environment and total fat intake. Nine showed relationships between environment and saturated fat intake. More research is needed before conclusions can be made.

Holsten 2008 Study Design: Systemic Review Class: M Rating:	N=7 studies.	MEDLINE, CINAHL, PubMed, Chochrane Central Register of Controlled Trials and CRISP were searched in order to find studies that included BMI as a continuous or categorical variable and that had a physical measurement of environmental variables related to food outlets.	Five studies found associations between obesity and the food environment, including presence of food stores, fruit and vegetable prices, neighborhood disadvantage, distance to the food store and number of fast-food restaurants. Many studies had limitations, and more research is needed to generate an overall conclusion.
Jago et al 2007 Study Design: Systematic Review Class: M Rating:	N=31 studies.	A search of PubMed and PsycINFO was conducted using the following keywords: Availability, accessibility, fruit and vegetables and studies published between 1993 and 2006 were included.	The availability of fruits and vegetables was associated with intake, and this relationship was mediated by SES and preference. Δs in availability are likely to mediate changes in consumption.
Kamphuis et al 2006 Study Design: Systematic Review Class: M Rating:	N=24 studies.	A search was conducted to identify observational studies published between January 1, 1980 and December 31, 2004 that included adults aged 18 to 60 years old. Studies included measures of accessibility and availability of fruits and vegetables, social conditions, cultural conditions, socioeconomic conditions and fruit and vegetable intake.	Living in an economically advantaged area, good availability, having a vegetable garden and a supermarket in the census tract were positively associated with fruit and vegetable intake. Living in an economically disadvantaged neighborhood and low household income were negatively associated with fruit and vegetable intake. There is not enough evidence to justify interventions targeting

			specific environmental factors.
Papas et al 2007 Study Design: Systematic Review Class: M Rating:	N=20 studies.	A MEDLINE search was conducted to identify studies published between 1966 and 2007 that included a direct measurement of body weight and at least one objective measure of the built environment.	Obesity was positively associated with fast food restaurant density, ↑ presence of convenience stores and greater distance to a supermarket, and negatively associated with ↓ food prices for fruits and vegetables. More research on the built environment and obesity is needed.
van der Horst et al 2007 Study Design: Systematic Review Class: M Rating:	N=58 studies.	Studies were identified through a computerized database search, were published between January 1980 and December 2004, had subjects aged three to 18 years, measured obesity-related dietary behaviors and assessed some aspect of the environment.	A positive, but inconsistent, association was found for availability and accessibility on children's fruit and vegetable intake. More studies examining environmental factors using longitudinal study designs and validated measures are needed for solid evidence to inform interventions.

Research Design and Implementation Rating Summary
For a summary of the Research Design and Implementation Rating results, click here.

Worksheets

Black JL, Macinko J. Neighborhoods and obesity. Nutr Rev. 2008 Jan;66(1):2-20.

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van der Horst K, Oenema A, Ferreira I, Wendel-Vos W, Giskes K, van Lenthe F, Brug J. A systematic review of environmental correlates of obesity-related dietary behaviors in youth. Health Educ Res. 2007 Apr;22(2):203-26.